

OKI Semiconductor

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ML63293

Preliminary

4-Bit Microcontroller with Built-in LCD Driver (68SEG. × 32COM.) and Melody Circuit

GENERAL DESCRIPTION

The ML63293 is a CMOS 4-bit microcontroller with built-in LCD driver and Melody circuit.
 The ML63293 is an M63xxx series mask ROM-version product of OLMS-63K family, which employs Oki's original CPU core nX-4/250.
 The ML63293 contains 64K-word program memory, 3K-nibble data memory, 4-bit input port, 16-bit output ports, 24-bit input/output port, LCD driver for up to 2176 segments, and melody circuit.

The ML63Q290 is the flash EEPROM version of ML63293.
 The ML63Q290 is used to evaluate the software development.

APPLICATION

The ML63293 is suitable for applications such as games, toys, watches, etc. which are provided with an LCD display and Melody output.

FEATURES

- Extensive instruction set
 - 408 instructions
 - Transfer, rotate, increment,/decrement, arithmetic operations, comparison, logic operations, mask operations, bit operations, ROM table reference, external memory transfer, stack operations, flag operations, jump, conditional branch, call / return, control.
- Wide variety of addressing modes
 - Indirect addressing of four data memory types, with current bank register, extra bank register, HL register and XY register.
 - Data memory bank internal direct addressing mode.
- Processing speed
 - 2 clocks per machine cycle, with most instructions executed in 1 machine cycle.
 - Minimum instruction execution time : 61μs (@32.768kHz system clock)
 - 1μs (@2MHz system clock)
- Clock generation circuit

Low-speed clock	: Crystal oscillation or RC oscillation selected with mask option (30k to 80kHz)
High-speed clock	: Ceramic oscillation or RC oscillation selected with software (2MHz max.)

The information contained herein can change without notice owing to product and/or technical improvements. Before using the product, please make sure that the information being referred to is up-to-date.

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- Program memory space
 - 64K words
 - Basic instruction length is 16 bits / 1 word
- Data memory space
 - 3K nibbles
- External data memory space
 - 64K bytes (expandable by using an I/O port)
- Stack level
 - Call stack level : 16 levels
 - Register stack level : 16 levels
- I/O ports
 - Input ports : Selectable as input with pull-up resistance/ input with pull-down resistance / high-impedance input
 - Output ports : Selectable as P-channel open drain output / N-channel open drain output / CMOS output / high-impedance output
 - Input-output ports : Selectable as input with pull-up resistance / input with pull-down resistance / high-impedance input
Selectable as P-channel open drain output / N-channel open drain output / CMOS output / high-impedance output
 - Can be interfaced to external devices having different power supplies.
 - Number of ports:
 - Input ports : 4bits (1port × 4bits)
 - Output ports : 16bits (4ports × 4bits)
 - Input-output ports : 24bits (6ports × 4bits)
- Melody output function
 - Melody sound frequency : 529 to 2979Hz
 - Tone length : 63 varieties
 - Tempo : 15 varieties
 - Melody data : Stored in program memory
 - Buzzer driver signal output : 4kHz
- LCD driver
 - Number of segments : 2176 segments max. (68seg. × 32com.)
 - Duty : Selectable as 1/2,1/4,1/6,1/8,1/10,1/12,1/14,1/16,1/18,1/20,1/22,1/24,1/26,1/28,1/30, 1/32
 - Bias : Selectable as 1/5 or 1/6 (internal Voltage regulator)
 - Frame frequency : 64 Hz
 - Contrast : 8 levels
 - Display modes : Selectable as all-ON mode, all-OFF mode, power down mode, and normal display mode

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· Multiplier / divider circuits

Multiplier : (8 bits) $\times$ (8 bits) $\rightarrow$ Product (16bits)Divider : (16 bits) / (8 bits) $\rightarrow$ Quotient (16bits), Remainder (8 bits)

· System reset function

System reset by RESET pin

System reset by power-on detection

System reset by detection that low-speed clock has stopped oscillation

· Battery check

Function that detects battery low voltage

Selection of judgment voltage by software (LD1 and LD0 bit settings of BLDCON)

LD1	LD0	Judgement voltage (V)	Comments
1	0	1.80 ± 0.10	Ta=25°C
1	1	2.40 ± 0.10	Ta=25°C

· Timers and Counter

8-bit timer

: 4 channels

Selectable as auto-reload mode, capture mode,
clock frequency measurement mode

Watchdog timer

: 1 channel

100Hz timer

: 1 channels

1/100 sec. Measurement possible

15-bit time-base counter
signals: 1Hz, 2Hz, 4Hz, 8Hz, 16Hz, 32Hz, 64Hz, and 128Hz
can be read

· Serial port

Mode

: Selectable as UART mode, synchronous mode

UART communication speed

: 1200 bps, 2400 bps, 4800 bps, 9600bps

Clock frequency in synchronous mode :

Internal clock mode (32.768kHz), External clock frequency

Data length

: 5 to 8 bits

· Shift register

Shift clock

: System clock $\times 1$, $\times 1/2$,

Timer 1 overflow (16-bit timer mode), External clock

Data length

: 8 bits

· Interrupt sources

External interrupt

: 5

Internal interrupt

: 14

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· Operating temperature
- 20 to +70 °C

· Operating voltage
1.8 to 3.5V

· Shipping products

Chip (169 pads)

176-pin flat package (176LQFP)

LQFP176-P-2424-0.50-BK

:(Product name: ML63293 - xxx)

:(Product name: ML63293 - xxxUA)

xxx indicates a ROM code number.

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BLOCK DIAGRAM

An asterisk (*) indicates the port secondary function.

